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Simon Anthony Brown

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EXAMINER

SINGAL, ANKUSH K

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No. 10/573,123	Applicant(s) BROWN ET AL.	
	Examiner Ankush k. Singal	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-46 is/are pending in the application.
- 4a) Of the above claim(s) 39 and 46 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 41-46 is/are allowed.
- 6) ☒ Claim(s) 1-38 and 40 is/are rejected.
- 7) ☒ Claim(s) 41-45 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>05/08/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 34 is objected to because of the following informalities:

In claim 34, the applicant uses the term, "may", in line 3 which creates ambiguity.

A reference not having any of the features listed in the claim can be read on the

claim due to the ambiguity. Secondly, the reference to the V-groove lacks

antecedent basis as this term was never found in claim 1. Appropriate

correction is required.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

1. Claims 1-3, 6, 10-15, 26-28, 35-37 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al.(Channel Waveguides Fabricated in 2D Photonic Crystals of Si Nanopillars, Microelectronic Engineering(2002)).

Re. claims 1 and 40 , Tada et al. discloses a method of forming a pattern on or in a substrate surface comprising or including the steps of: a) Providing a substrate; b) modifying the substrate surface to provide a topographical feature, or identifying a topographical feature on the substrate surface; c) preparing a plurality of particles; d) deposition of a plurality of the particles on the substrate surface in, or in the general vicinity of, the topographical feature; e) formation of an arrangement of particles via accumulation of the particles, into or against or proximal to, the topographical feature; f) removing at least a portion of the substrate by etching, the arrangement of particles acting as an etch mask(Figure 1 and 2).

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However, Tada et al. does not teach the size of particles between 0.5 nm and 100 microns. However Tada et al. disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Tada et al. method.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Re. claim 2 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 except the size of the particles is between about 0.5 nm and 1000 nm. However Tada et al. disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Tada et al. method.

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Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Re. claims 3 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the substrate is at least partially an insulating or semi conducting material (Page 261). [Si is a semiconductor material.]

Re. claim 6 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the modification includes formation of a step. Depression or ridge in the substrate surface (Figure 2).

Re. claim 10 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the particles are composed of two or more atoms, which may or may not be of the same element. [Fe nuclei]

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Re. claim 11 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including wherein the accumulation of particles into or against or proximal to, the topographical feature relies upon the diffusion, sliding, bouncing or other movement of the particles across or on the surface of the substrate or any material deposited on the substrate.

Re. claim 12 as discussed above in claim 3, Tada et al. discloses all the limitations as discussed above in claim 3 including the substrate is at least partially an insulating or semiconducting material(Page 261). [Si is a semiconductor material.]

Re. claim 13 as discussed above in claim 12, Tada et al. discloses all the limitations as discussed above in claim 12 including the etching step removes substantially all of the substrate other than the masked portion thereby leaving a free-standing wire or bridge(Figure 2). [Substantially is a relative term and all the material on the substrate other than that covered by the mask is removed.]

Re. claim 14 as discussed above in claim 3, Tada et al. discloses all the limitations as discussed above in claim 3 including wherein the substrate is an insulating or semiconductor material with one or more surface coatings selected from one or more of a metallic and/or insulating and/or semi conducting material, and wherein one of more of the surface coatings may have been deposited before or after step b) of modifying

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the substrate surface(Figure 2).[Si=semiconductor; Fe clusters + PMMA + acetone= surface coatings]

Re. claim 15 as discussed above in claim 14, Tada et al. discloses all the limitations as discussed above in claim 14 including the etching step removes substantially entirely all of one or more of the one or more surface coatings other than the masked portion(All of the PMMA and acetone are removed as seen in Figure 2).

As to claim 26 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the particles are metallic clusters.

Re. claim 27 as discussed above in claim 26, Tada et al. discloses all the limitations as discussed above in claim 1 including the particle/Nano particle preparation and deposition steps are via other similar cluster preparation method, and the nanoparticles are atomic clusters made up of a plurality of atoms which may or may not be of the same element(Figures 1 and 2).

Re. claim 28 as discussed above in claim 3, Tada et al. discloses all the limitations as discussed above in claim 3, including the semiconductor or insulator of the substrate is silicon as an alternative to the instant invention.

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Re. claim 35 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the etching step f) results in removal of the substrate material and some or all of any coating materials (if present) in preference to the arrangement of particles(Figure 2).

Re. claim 36 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 including the etching step f) results in removal of the non-masked coating material in preference to the substrate material (Figure 2).

Re. claim 37 as discussed above in claim 36, Tada et al. discloses all the limitations as discussed above in claim 36 including the etching step is a plasma etching (Figure 2).

2. Claims 4-5, 7-9, 16-25, 29-34 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tada et al.(Channel waveguides fabricated in 2D photonic crystals of Si nanopillars, Microelectronic Engineering(2002)) in view of Muller et al.(Template- Directed self-assembly of buried nanowires and the pearling instability).

As to claims 4 and 5, Tada et al. discloses all the limitations of the nanostructure as discussed above in claim 1 with the exception of the ultimate use or formation of a pattern being a nanowire made of chain of metallic clusters. However, Muller teaches the formation of a nanowire using a line of germanium nanoclusters in a nanostructure similar to that of Tada. Therefore, it would have been obvious to one of ordinary skill in

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the art to use the end structure of Tada in the manner as taught by Muller as Muller does not clearly disclose how its initial V-grooved nanostructure is created.

Re. claim 7 as discussed above in claim 6, Tada et al. discloses all the limitations as discussed above in claim 6 except the modification comprises formation of a groove having a substantially v-shaped cross-section or inverted pyramid structure running substantially between the contacts.

However, Muller et al. teaches modification comprises formation of a groove having a substantially v-shaped cross-section or inverted pyramid structure running substantially between the contacts for the fabrication of spatially controlled nanostructures.

Therefore it would have been obvious for one with ordinary skill in the art at the time the invention was made to modify Tada et al. as taught by Muller et al. for the modification comprising formation of a groove having a substantially v-shaped cross-section or inverted pyramid structure running substantially between the contacts.

Re. claim 8 as discussed above in claim 7, Tada et al. and Muller et al. discloses all the limitations as discussed above in claim 7 including the surface modification involves lithography(Page2, Muller et al.).

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Re. claim 9 as discussed above in claim 8, Tada et al. and Muller et al. discloses all the limitations as discussed above in claim 8 including the surface modification step involves the use of etching and takes advantage of the different etch rates of crystallographic planes in the substrate material(Page 2, Muller et al.).

Re. claim 16 as discussed above in claim 15, Tada et al. discloses including the substrate comprises an insulating or semiconductor material (Si) coated with one or more metallic and/or semi-conducting layer(s)(Fe) , the metallic and/or semiconducting layer(s) being crystalline, nano- or micro-crystalline, or amorphous(Figure 2).

Re. claim 17 as discussed above in claim 16, Tada et al. discloses all the limitations as discussed above in claim 16 except the metallic layer is formed by cluster deposition of a plurality of clusters, prior to and having a different identity to, the plurality of particles formed and deposited in steps c) and d).

However, Muller et al. teaches the metallic layer forming the line is formed by cluster deposition of a plurality of clusters, prior to and having a different identity to, the plurality of particles formed and deposited in steps c) and d) for the fabrication of spatially controlled nanostructures. This material would provide the eventual conductive line pattern in an effective manner and with material and apparatus which are similar to that used in Tada.

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Therefore it would have been obvious for one with ordinary skill in the art at the time the invention was made to modify Tada et al. as taught by Muller et al. for the formation of metallic layer by cluster deposition of a plurality of clusters, prior to and having a different identity to, the plurality of particles formed and deposited in steps c) and d) for the fabrication of spatially controlled nanostructures.

As to the issues of homogenous and not homogeneous as recited in claims 18 and 19, Tada et al. discloses all the limitations of the base claim(s) except the metallic layer or semiconducting layers being homogeneous or not homogenous. Muller shows that when using a structure having a topographical feature to initially have the layers be homogeneous and then implant with Ge to create the line, wherein, the final product appearing to be non-homogeneous but conductive as seen in Figure 4. Furthermore the reference describes "pealizing" in the introduction which suggests a non-homogeneous final structure.

Re. claim 20 as discussed above in claim 1, Tada et al. and Muller et al. discloses all the limitations as discussed above in claim 1 including the method may also include treatment of the substrate surface such as by passivation, or adding an insulating layer such as SiOx or SiN, at some point prior to any coating of the substrate with the one or more metallic and/or semiconducting layers(Figure 1, Muller et al.).

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Re. claim 21 as discussed above in claim 1, Tada et al. and Muller et al. discloses all the limitations as discussed above in claim 1 including the method may also include the step of coating of the substrate surface such as by adding an insulating layer such as SiO_x or SiN, or different semi-conducting layer, for the purpose of electrical insulation or prevention of oxidation of the metal or semi-conducting layer, at some point subsequent to the substrate being coated with the one or more surface coatings selected from one or more of a metallic and/or insulating and/or semiconducting material (Figure 1, Muller et al.).

As to claims 22 and 23 as discussed above in claim 1, Tada et al. discloses all the limitations as discussed above in claim 1 with the exception of an additional lithography step or steps to provide electrical contact to the pattern(Figure 2). However, to provide contact to the metallic line of Muller some form of hole must be made in the silicon oxide layer. A notoriously well known (of which the Examiner takes Official Notice) method of doing this is thru lithographic procedures. Such a process is needed for otherwise the purpose of forming the metallic wire would be lacking. It would have been obvious to one of ordinary skill in the art to cut thru the silicon oxide layer of Muller in the Tada/Muller combination to make contacts so as to achieve the purpose of having the metallic line.

As to claims 24 and 25, Tada et al. discloses all the limitations as discussed above in claim 23 except lithography is used to form two contacts which are separated by a

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distance smaller than 100 microns. However disclosure for given conditions of the claimed invention, the claim range is considered to be an obvious matter of finding an optimum workable range for some chosen design requirement utilizing Tada/Muller combination.

Note that it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves routine skill in the art. In re Aller, 105 USPQ 233.

Any difference in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

As to claims 29 and 30, Tada et al. and Muller both disclose the one or more surface coatings iron and germanium.

As to claims 31, 32, 33 and 34, Tada et al. discloses all the limitations as discussed above in claim 26 except the angle of incidence of the deposition of clusters onto the substrate or the angle of the topographical feature(s) on the substrate is controlled so as to affect the density of particles or their ability to slide, stick or bounce, in or on any part or parts of the substrate. Muller, however, recites that in the use of a similar

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structure as that of Tada that the density of the germanium cluster wire depends on the angle of incidence of the deposition of the clusters into the V-shape or of the angle of the topographical feature. See Section II of Muller. Therefore, in order to improve the density of the wire, one would alter the angle of the feature or of the deposition to optimize the density according to a desired value. Muller also discloses that controlling the magnetron sputtering and aggregation parameters can control the kinetic energy of the particles deposited. See Section II of Muller in that the temperature and the power were used to control the deposition.

As to claim 38, Tada does not specifically recite removal of the mask. However, in using the final structure of Tada in Muller, the masking units would have to be removed so as to generate a smooth uniform silicon oxide layer and would modify the kinetics of the implantation or diffusion of the germanium in making the germanium wire. One of ordinary skill in the art would remove the mask for the reasons indicated.

Allowable Subject Matter

3. Claims 41-45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

4. Claim 41 is allowed over prior art of record as the prior art does not teach one or more metallic or semi conducting layers are deposited on the substrate surface, such

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that the etching process removes substantially all of the one or more metallic or semi conducting layers other than the masked portion, and wherein the process also includes, at any stage, a step of providing electrical contacts on the substrate so that once etching is complete a conducting pattern exists between the contacts; and B. incorporating the contacts and wire into the device.

Claims 42-45 are also allowed as being dependent on claim 41.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ankush k. Singal whose telephone number is 5712701204. The examiner can normally be reached on monday-friday 7am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW SMITH can be reached on (571)272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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